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Susceptibility of Roller-Chopped Jack Pine Stumps to Infection by *Heterobasidion annosum*

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INTRODUCTION

Heterobasidion annosum (Fr.) Bref. (= Fomes annosus (Fr.) Karst) was first found killing jack pine, Pinus banksiana Lamb., in two root disease centers on the Bessey Ranger District, Nebraska National Forest, in late 1964 (Stewart 1965). A large forest fire in 1965 destroyed the stands where the root disease centers had been found. Since then, H. annosum fruiting bodies and root disease have been found in jack pine in one center on the Coyote Sale (1982 and 1985), in two centers on the Bullsnake Sale (1985), and east of the Coyote Sale on Forest Service Road 214 (1987) (Fig. 1). A fifth location in the study area (part of the Coyote Sale) with an amorphous cream-colored conk on a cut stump was determined negative for H. annosum (1987).

The Bessey District has an active prevention program which requires borax treatment of all freshly cut stumps. To facilitate the decomposition of slash, the District runs a roller-chopper over clearcut areas a few months after the sale closes. (Attempts at shelterwood cuts have resulted in excessive blowdown due to strong winds and sandy soil, thus clearcutting is the preferred silvicultural method.) Stumps are from a few months to a few years old when roller chopping takes place.

Roger Keepers, Silviculturist, Nebraska National Forest, contacted Forest Pest Management concerning whether roller-chopping borax-treated jack pine stumps would create wounds susceptible to H. annosum infection. This evaluation was undertaken to address this question.

MATERIALS AND METHODS

Study Area

A clearcut in the West Coyote Sale area, west of Forest Service Road 203 in T.22N, R.26W, S.27, was completed and closed in February 1987 (Fig. 1). Bessey District personnel ensured that the wood cutter put borax on the stumps at the time of cutting. The area was roller chopped May 28, 1987, after a heavy rain the previous night.

Sampling (May 28, 1987)

Thirty wood samples were collected from 18 stumps immediately after the roller chopper passed over the stumps and slash. The roller chopper missed some stumps while creating several-centimeter gashes or slicing edges off others (Fig. 2). Samples were chunks of wood collected with pliers and clippers at fresh splits and slices in the roller-chopped stumps. Tools were disinfected with 70% isopropanol between samples. Samples were placed in individual ziplock plastic bags and kept in a cooler during transport and before inoculations at the FPM lab in Lakewood, Colorado.

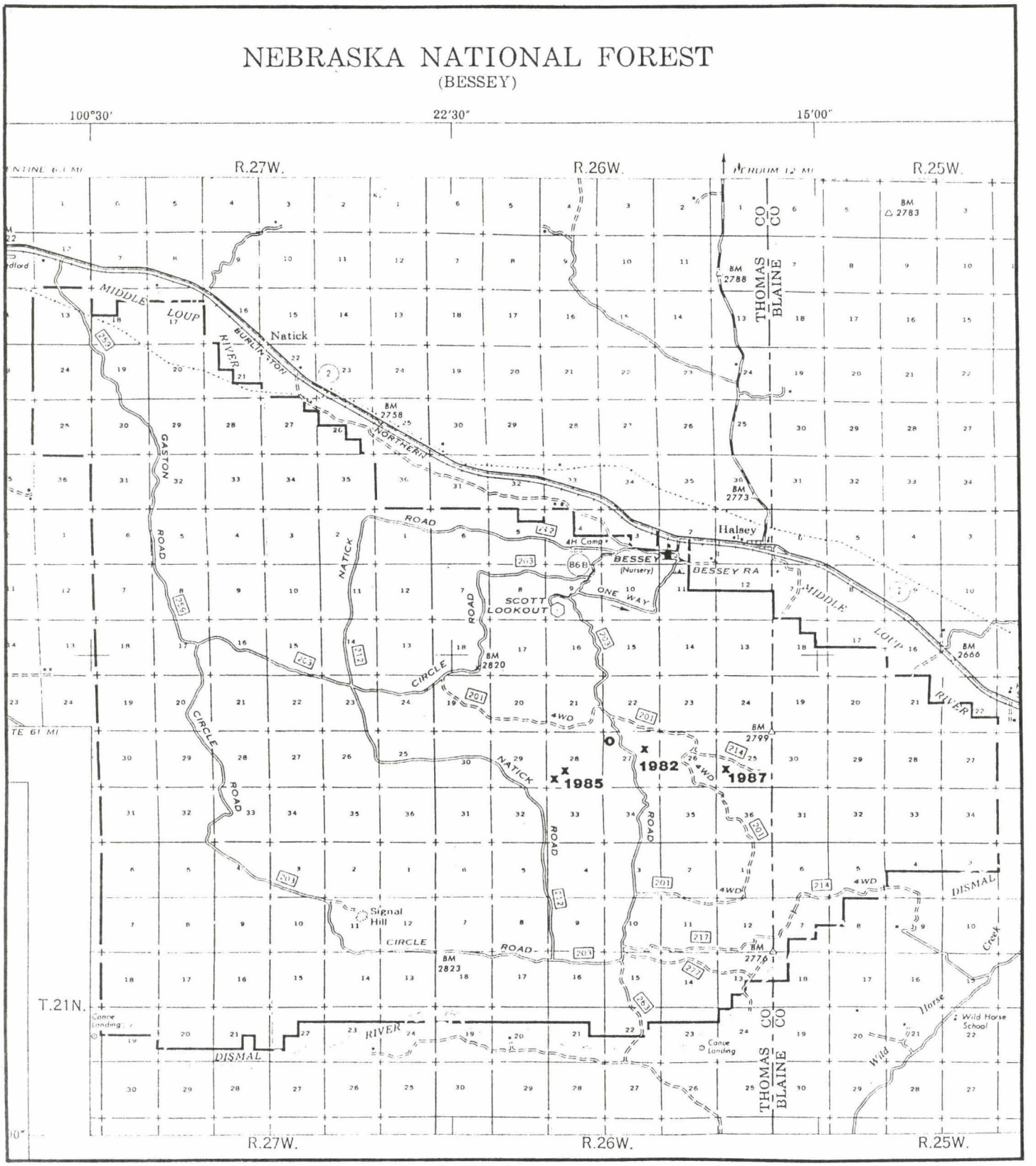


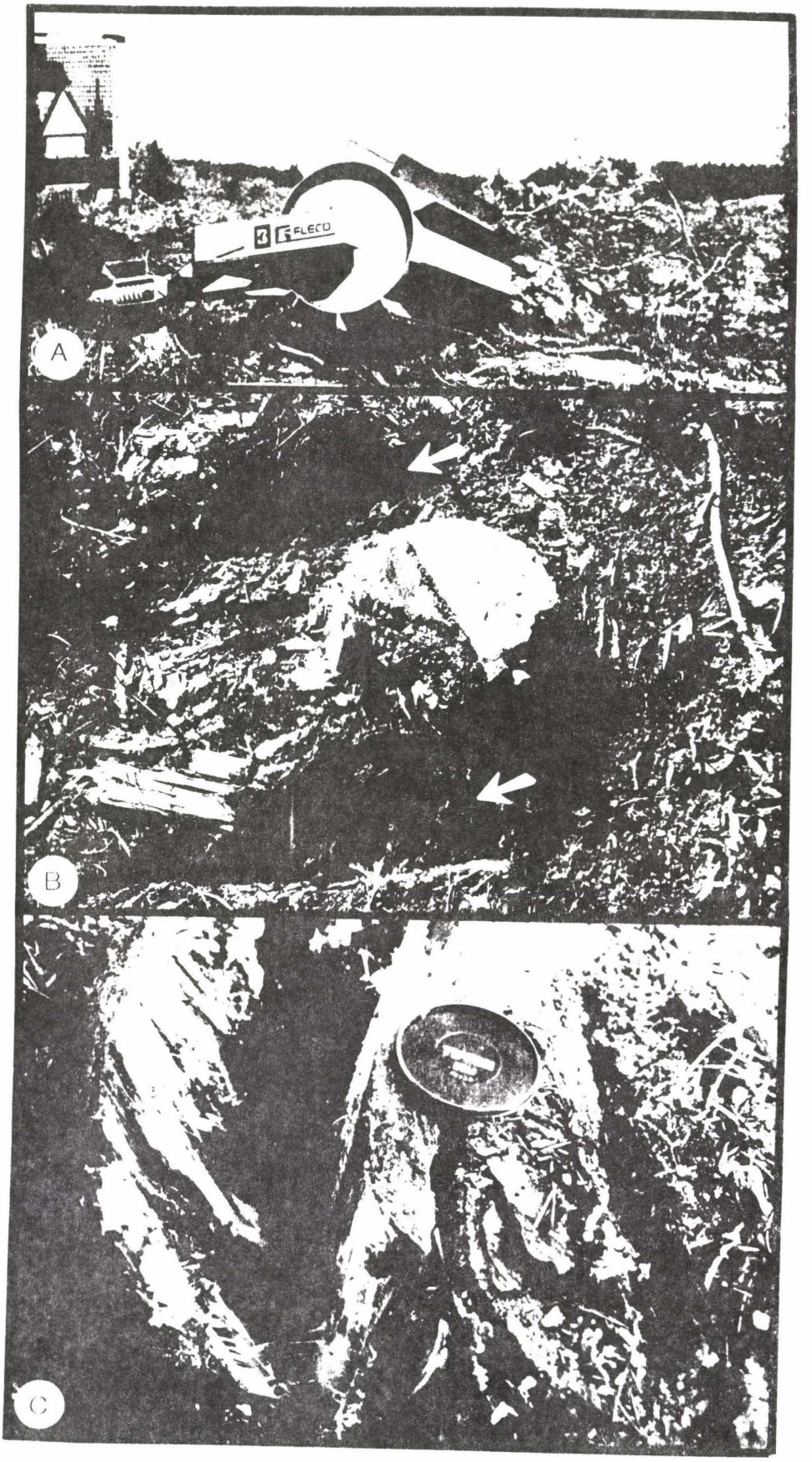
Figure 1. Location of study area (o), and locations (x) and year of discovery of infection centers of Heterobasidion annosum in jack pine, Bessey Ranger District, Nebraska National Forest.

Figure 2.

A. Roller-chopper is filled with water, then rolled across slash.

B. Stump missed by the blades of the roller-chopper (arrows), but partially crushed by the drum between blades.

C. Stump with several-centimeter slice (below lens cap) and portion of bark sheared off.


FLECO
A
B
C

Inoculation (June 1, 1987)

From each of the original 30 samples, two wood-chip subsamples were split aseptically. Wood chips ranged from 5.5 to 47.6 cm^2 in surface area, and were shaped roughly like triangular prisms. Each wood chip was placed in a small ziplock bag and numbered. One of each pair of wood chips was inoculated with 1 ml of spore suspension, while the other received 1 ml sterile water as a control. The spore suspension consisted of sterile water with spores and bits of mycelium collected with an inoculating loop from the surface of 5-day-old cultures of H. annosum on potato dextrose agar (PDA). The original isolate was cultured from infected subalpine fir, Abies lasiocarpa (Hook.) Nutt., in southern Colorado, and kept in culture on PDA since fall 1981. Dilution plates (PDA) were inoculated with various amounts of the spore suspension to determine the concentration of propagules. Wood chips and dilution plates were incubated at 21°C in an environmental chamber with 12 hours of light and 12 hours of darkness. Each milliliter of spore suspension used to inoculate the wood chips contained at least 95 H. annosum propagules, as a conservative estimate. Wood chips were examined after three weeks and again after five months, for the Oedocephalum state of H. annosum.

RESULTS

The dilution plates yielded profuse Oedocephalum annosum sporulation with no contamination after three weeks. No Oedocephalum was found on any of the wood chips. Chips were either not colonized by fungi or were colonized by species of Alternaria, Penicillium, a fungus similar to Gonatobotryum, Trichoderma, Graphium, Paecilomyces, Heteroconium, or other unidentified Deuteromycetes, or algae. Seven percent of the wood chips (four out of 60) had become dry in the small ziplock bags after five months. Mites were found in seven percent of the wood chips.

DISCUSSION

The general understanding is that only freshly exposed (less than one hour to two weeks old) trunk or root surfaces are susceptible to infection by H. annosum (Bega 1963; Cobb and Schmidt, 1964; Kliejunas 1985). The investigations of Russell and others (1973), however, have suggested pine stumps may be susceptible for several months in Washington due to rains and humidity. In California (Kliejunas 1985), stumps less than 8"diameter rarely become infected because temperatures lethal to H. annosum are reached in the stumps (one hour at 40°C). Stumps cut close to the ground remain cooler and are easily covered with duff (which can contain inoculum).

On the Bessey District, stumps are cut close to the ground, a large portion of stumps are less than 8" diameter, and summers are hot and humid. The duration of pine stump susceptibility to infection by H. annosum on the Bessey District is not known.

Johnson and Cowling (1965) showed that three months after felling and treating slash pine stumps with borax, the borate ion penetrates 23-30 cm into the stumps. They also showed that competitive saprophytes such as Trichoderma and Peniophora are much less sensitive to borax than H. annosum. As stumps dry out after cutting, cracks commonly develop to a depth of several centimeters. The penetration of the borate ion helps render these new surfaces not susceptible to infection by H. annosum (Johnson and Cowling, 1965).

It is not clear whether the conditions of this evaluation precluded infection in wood chips from otherwise susceptible wounds. The isolate from fir may not be infective to jack pine. The saprophytic microorganisms on the wood chips may have had greater competetive advantage under laboratory conditions.

However, because of tissue dessication and penetration of the borate ion, it is probably true that fresh stumps treated with borax and roller chopped a few months later are not susceptible to infection by H. annosum. In conclusion, there appears to be no reason to defer roller-chopping harvested areas.

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